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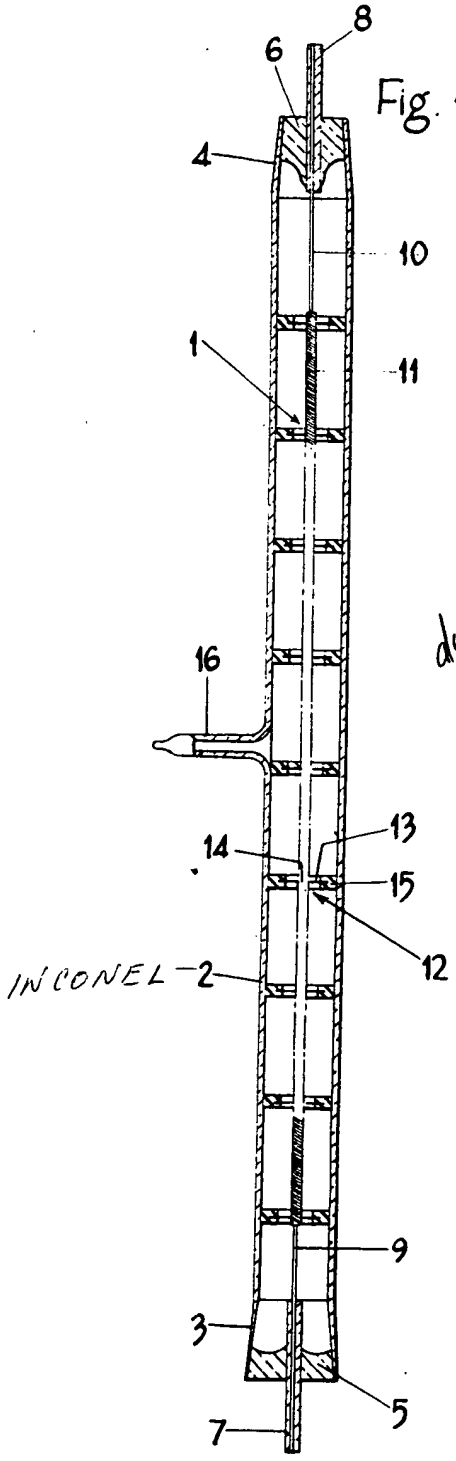
864,318 COMPLETE SPECIFICATION

1 SHEET

Fig. 1



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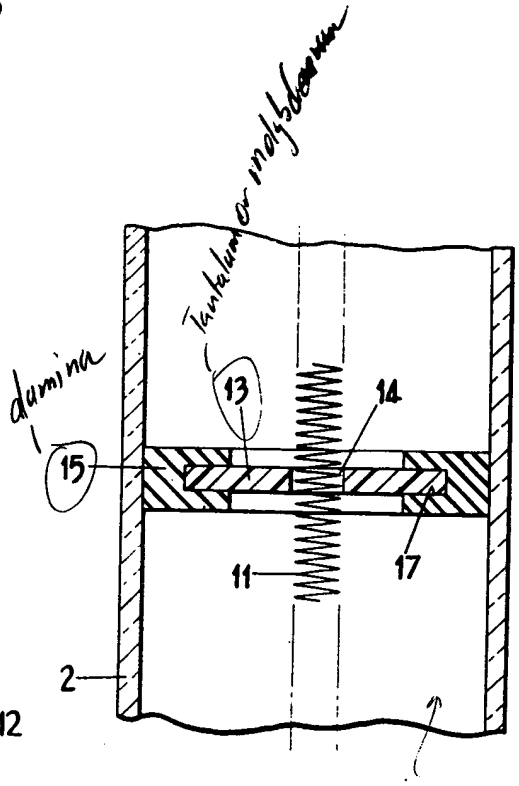

Fig. 2 inert gas

9, 10, 11
tungsten, molybdenum

PATENT SPECIFICATION

864,318

Inventor: DENNIS LAWRENCE LEWIS

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Index at Acceptance:—**Class 39(3),** H1L, H2E(4G2:4G3:9:11).

International Classification:—H05b.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements in or relating to Electric Heating Elements

WE, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electric heating elements and an object of the invention is the provision of a robust tubular or sheathed element which may be used for a variety of purposes such as in electric cookers, process heating equipment, and domestic space heating equipment.

According to the prestnt invention, an electric heating element includes a metallic tube having heat resisting properties, a metallic heating filament extending along inside the tube, and a plurality of insulating supports for the filament spaced apart along the length thereof within the tube, the tube being sealed and containing an inert atmosphere.

The metallic tube may be of circular cross-section and straight, and the metallic filament may be a coiled filament extending along the axis of the tube. The tube may be of a nickel, chromium, iron alloy such as the alloy known under the Registered Trade Mark INCONEL or that known under the Registered Trade Mark INCOLOY and the filament may be of tungsten or molybdenum arranged to run at a temperature of 2000 to 2500°K. The tube surface temperature may be about 1000 to 1500°K.

The insulating supports may be slotted discs of metal such as tantalum or molybdenum each held in an annulus of heat resisting, insulating material such as alumina, boria or beryllia.

The inert atmosphere in the tube may be an argon/nitrogen mixture.

[Price 3s. 6d.]

In order that the invention may be fully understood, one construction of an electric heating element, in accordance with the invention, will now be described by way of example, with reference to the two figures of the accompanying drawing, in which Figure 1 shows a longitudinal section taken through the heating element, and Figure 2 shows an enlarged view of a portion of the heating element shown in Figure 1, the portion including one filament mounting disc.

Referring now to Figures 1 and 2 of the drawing, the electric heating element 1 comprises a straight length of INCONEL tube 2 of about 10 inches in length and 0.5 inch diameter and one end 3 of the tube 2 is flared and the other end 4 is tapered, the ends 3 and 4 each being arranged to accommodate a glass to metal seal. The seal in the end 3 of the tube 2 is designated 5 and the seal in the end 4 of the tube 2 is designated 6. Nilo-k tubes 7 and 8 are mounted in the seals 5 and 6 respectively, being set coaxially therewith, (NILO being a Registered Trade Mark), and the tubes 7 and 8 are united and sealed to their respective seals 5 and 6. The tubes 7 and 8 each have extending therethrough a tungsten or molybdenum rod 9 or 10 the rods 9 and 10 each acting as a lead to an electric filament which will be referred to more specifically later, and are welded or brazed in the tubes 7 and 8, with which they are respectively associated, in a gas-tight manner.

The two filament rods 9 and 10 are, of course, on the axis of the main heater tube 2 and extending between them is a coiled filament 11 of tungsten or molybdenum wire, the filament 11 being under slight tension and being supported in the INCONEL tube 2 by a plurality of insulating supports 12 spaced apart along the length of the tube as shown in the drawing, in which only one

support has been referenced, all the other supports shown being identical in construction to the support indicated at 12. Each of the supports consists of a thin disc 13 of tantalum, molybdenum or other suitable material having a central hole 14 for the filament 11 and a slot (not shown) running from the hole 14 to the periphery of the disc 13 to allow the disc 13 to be fitted on the filament 11, and an annulus 15 of insulating heat-resisting material such as alumina in which the disc 13 is sprung; each annulus 15 has an internal groove 17 to receive its disc 13. In assembling the insulating supports 12 on the filament, each disc 13 would be placed on the filament 11 in the required position by flexing the disc 13 to open the slot and sliding the disc 13 onto the filament 11, fixed around the perimeter of the disc 13.

The main tube 2 is provided with a pumping side tube 16 so that it can be pumped out and filled with an inert gas after insertion and sealing of the filament 11 in the tube and in manufacture of the heater 1, the filament 11 complete with supports 12, filament rods 9 and 10 and seals 5 and 6 is slipped into the flared end 3 of the tube 2, until the seal 6 engages the tapered end 4 of the tube 2, the rods 9 and 10 being previously sealed in the tubes 7 and 8. Thereafter, the ends 3 and 4 are heated to attach the seals 5 and 6 to the tube 2 and then the heater 1 is pumped, filled with inert gas and sealed off at the side tube 16.

Instead of using glass to metal seals for the ends of the filament 11, ceramic material such as SINTOX (Registered Trade Mark) may be used and if directional effects are required, portions of the inside of the tube 2 may be coated to make them reflecting and increase the ouput from diametrically opposite portions of the tube 2.

An electric heating element according to the present invention is robust and suited to several applications for which elements known as the sheathed wire type are used. The element may have a higher loading per linear inch than normal forms of sheathed wire element since the limits normally imposed by the compacted refractory insulating material are absent and the filament can be run much hotter than the coil of a sheathed wire element. Further the element is of low thermal mass and has a more rapid response than other forms of electric heating elements.

WHAT WE CLAIM IS:—

1. An electric heating element including a metallic tube having heat resisting properties, a metallic heating filament extending along inside the tube, and a plurality of insulating supports for the filament spaced apart along the length thereof within the tube, the tube being sealed and containing an inert atmosphere.
2. An electric heating element as claimed in Claim 1, wherein the metallic tube is of circular cross-section and straight.
3. An electric heating element as claimed in Claim 2, wherein the metallic filament is a coiled filament extending along the axis of the tube.
4. An electric heating element as claimed in Claim 1, 2 or 3, wherein the tube is made of a nickel, chromium iron alloy.
5. An electric heating element as claimed in any of the Claims 1-4, wherein the metallic heating filament is sealed in the tube by means of glass to metal seals.
6. An electric heating element as claimed in Claim 5, wherein the metallic heating filament is sealed in the tube by means of ceramic seals.
7. An electric heating element as claimed in any preceding claim, wherein the insulating supports are in the form of slotted discs of high melting point metal each held in an annulus of heat resisting, insulating material.
8. An electric heating element as claimed in any preceding claim, wherein the inert atmosphere is an argon/nitrogen mixture.
9. An electric heating element substantially as hereinbefore described and with reference to the accompanying drawing.

For the Applicants,
F. S. PEACHEY,
Chartered Patent Agent.

PROVISIONAL SPECIFICATION

Improvements in or relating to Electric Heating Elements

WE, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2., a British Company, do hereby declare this invention to be described in the following statement:—

This invention relates to electric heating elements and an object of the invention is the provision of a robust tubular or sheathed element which may be used for a variety of purposes such as in electric cookers, process heating equipment, and domestic space heating equipment.

According to the present invention, an electric heating element includes a metallic tube having heat resisting properties, a metallic heating filament extending along inside the tube, and a plurality of insulating supports for the filament spaced apart along the length thereof within the tube, the tube being sealed and containing an inert atmosphere.

The metallic tube may be of circular cross-section and straight, and the metallic fila-

ment may be a coiled filament extending along the axis of the tube. The tube may be of a nickel, chromium, iron alloy such as the alloy known under the Registered Trade Mark INCONEL or that known under the Registered Trade Mark INCOLOY and the filament may be of tungsten or molybdenum arranged to run at a temperature of 2000 to 25000°K. The tube surface temperature may be about 1000 to 1500°K.

The insulating supportd may be slotted discs of metal such as tantalum or molybdenum each held in an annulus of heat resisting, insulating material such as alumina, boria or beryllia.

The inert atmosphere in the tube may be an argon/nitrogen mixture.

In carrying the invention into effect, according to one example of construction, an electric heating element comprises a straight length of INCONEL tube of about 10 inches in length and 0.5 inch diameter and to each end of the tube is welded or nicrobrazed a funnel-shaped portion whose tubular part fits over the tube end, the portion being provided to enable the use of glass to metal seals and being of material such as the material known under the Registered Trade Mark Nilo. A Nilo-k tube is set on the axis of the funnel-shaped portion, is united and sealed to the portion by glass and has extending therethrough a tungsten or molybdenum rod which act as a filament lead and is welded or brazed in the tube in a gas-tight manner.

The two filament rods or leads are, of course, on the axis of the main heater tube and extending between them is a coiled filament of tungsten or molybdenum wire, the filament being under slight tension and being supported in the INCONEL tube by a plurality of insulating supports spaced apart along the length of the tube. Each of the supports, of which there may be one every 1-2 inches, consists of a thin disc of tantalum, molybdenum or other suitable material having a central hole for the filament and a slot running from the hole to its periphery to allow the disc to be fitted on the filament, and an annulus of insulating heat-resisting material such as alumina in which the disc is sprung; each annulus has an internal groove to receive its disc. In assembling the insulating supports on the filament, each disc would be placed on the filament in the required position by flexing the disc to open the slot and sliding the disc onto the filament and then the annulus fed onto the filament, fixed around the perimeter of the disc.

The main INCONEL tube is provided with a pumping side tube so that it can be pumped out and filled with an inert atmosphere after insertion and sealing of the filament in the tube and to manufacture the heater, one funnel-shaped portion may be prefixed to the tube, the filament complete with supports and filament rods or leads slipped into the other end of the tube, the second funnel-shaped portion sealed in place and then both rods sealed in the Nilo-k tubes. Thereafter, the heater is pumped filled with inert gas and sealed off at the side tube.

Instead of using glass to metal seals for the ends of the filament, ceramic material such as SINTOX (Registered Trade Mark) may be used and if directional effects are required, portions of the inside of the INCONEL tube may be coated to make them reflecting and increase the output from diametrically opposite portions of the tube.

An electric heating element according to the present invention is robust and suited to several applications for which elements known as sheathed wire type are used. The element may have a higher loading per linear inch than normal forms of sheathed wire element since the limits normally imposed by the compacted refractory insulating material are absent and the filament can be run much hotter than the coil of a sheathed wire element. Further, the element is of low thermal mass and has a more rapid response than other forms of electric heating elements.

For the Applicants,
F. S. PEACHEY,
Chartered Patent Agent.

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